

## Editorial process in scientific journals: analysis and modeling

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**Abstract** The editorial handling of papers in scientific journals as a human activity process is considered. Using recently proposed approaches of human dynamics theory we examine the probability distributions of random variables reflecting the temporal characteristics of studied processes. The first part of this paper contains our results of analysis of the real data about papers published in scientific journals. The second part is devoted to modeling of time-series connected with editorial work. The purpose of our work is to present new object that can be studied in terms of human dynamics theory and to corroborate the scientometrical application of the results obtained.

**Keywords** human dynamics · time-series modeling · editorial process analysis

### Introduction

Nowadays new possibilities for quantitative studying of human activity processes appear. Modern computer technologies allow to collect and to process large volumes of statistical data. It is possible to fix the time of each performed operation from large flow of human (customer/user/client) actions and to obtain the data set representing whole picture. Therefore, new methods for data analysis and knowledge discovering could be applied. In particular, this allows quantitative analysis of psychological, social and other aspects of human behavior.

The sequences of human actions (telephone calls, information queries or stock exchanges) are not new subject to study. But contrary to generally accepted opinion

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about human actions randomly distributed in time and thus well approximated by Poisson processes (interevent times are exponentially distributed), the comparatively recent results of human dynamics analysis show the presence of power laws which nature and origin are unexplained up till now [1,2,3]. This discovery attracts an interest and provokes analysis of new processes involving human actions in different fields of our life. The analysis of time statistics of human activity patterns can be useful for different optimization and control tasks in spheres of mass service, communication, information technologies, resource distribution, etc. Besides, this approach can give a new possibility to understand human behaviour and to get its additional quantitative measure.

The continuous human behaviour can be considered as the set of consecutive actions in time. In this case it is convenient to examine two characteristic random variables: the time interval between two consecutive actions (called the interevent time  $t_{\text{int}}$ ) and the time a task is waiting for an execution (the so-called waiting time  $t_w$ ). The power-law nature of corresponding distributions

$$P(t_{\text{int}}) \sim t_{\text{int}}^{-\alpha}, \quad P(t_w) \sim t_w^{-\beta}, \quad \alpha, \beta > 0 \quad (1)$$

arises from the analysis of real processes that involve human actions such as browsing the Internet, data downloading, electronic and mail communication, initiating financial transactions etc. [1,2,4]. On the other hand, the processes with execution of tasks in queue are the typical objects of study in the queueing theory which can be seen as the subfield of the so-called theory of mass service or, generally speaking, of applied probability theory [5,6]. So, it is natural to use some general terminology to describe such kinds of processes. An empirical analysis results in a variety of values of the exponents governing (1) [3,5], however an observed tendency when similar values of the exponents describe different processes gives rise to an analogy with the “universality classes” found in physics of critical phenomena [5]. Different models have been proposed to gain insight about an origin of power laws (1) [3]. Some of the proposed models are based on the assumption about the key role of priority-based (decision-based) queueing process [5]. The situation when an individual has to perform a list of tasks and chooses a task from this list using some internal priority is very natural. It is important, that power-law-like distributions (1) appear only in the so-called critical and supercritical regimes of service, when its traffic intensity  $\rho$ :

$$\rho = \lambda/\mu \quad (2)$$

is greater than 1. In (2)  $\lambda$  is the tasks arrival rate and  $\mu$  is the execution rate, respectively [5]. In other words, the probability distribution functions of human activity processes are close to power law only when the queue of tasks is not exhausted [5]. This class of human activity can be described by the so-called “task-driven” models [3]. On the other hand, the “interest-driven” models explain the existence of power laws in human dynamics in a different way. There, the power laws may be observed also for the processes without any possibility to determine the queue of tasks, for example visiting of web-sites by different users [3].

Thus, we can conclude that human dynamics theory is the issue of current importance. Often besides academic interest there is an obvious great practical value of the results obtained.

The main purpose of this paper is to gain insight on the editorial process in scientific journals using tools and concepts of the human dynamics theory. In the first

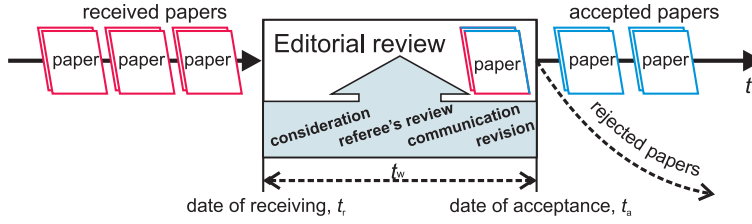
part (section 1) we show our empirical results obtained during the data analysis about distributions of waiting times of papers in several scientific journals. The simple simulation model of editorial processing of scientific manuscripts is presented in the second part of this paper (section 2).

## 1 Waiting times statistics analysis of scientific journals

Let us consider the editorial process in scientific journals as an example of human activity processes [7]. Keeping in mind the classification mentioned above, we will consider the “task-driven” model. In this kind of mass service system the input flow consists of submitted papers forming the queue. A standard procedure after paper submission can include the following steps: (i) peer-review process, (ii) revisions if necessary, (iii) acceptance by an Editorial Board, (iv) other intermediate processes. On each of the above stages the paper may be rejected. However, typically the information concerning the rejected papers is not publicly available. Therefore, we consider the random variable  $t_w$  defined as a number of days between the dates of the paper final acceptance  $t_a$  and the paper receiving  $t_r$ :

$$t_w = t_a - t_r.$$

All stages of the editorial processing of submitted manuscripts are considered together as the one process (Fig. 1). Though more than one actor takes part in it, we consider that every part of this work is controlled by an Editorial Board. Therefore, we can treat this process as one of the main characteristics of the Editorial Board activity.



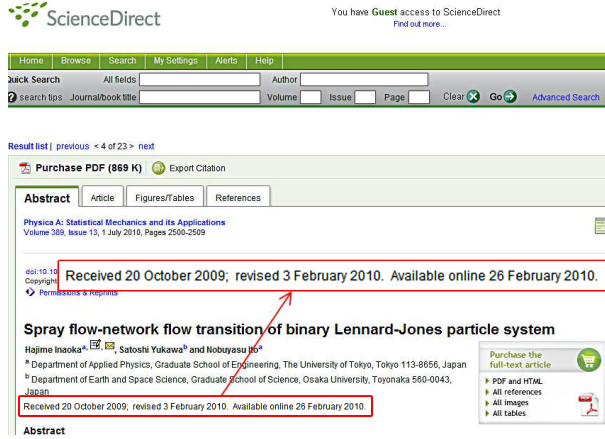
**Fig. 1** Schematic picture of editorial processing of manuscripts in scholarly journals.

During the real data analysis we met the problem of acceptance time  $t_a$  determining whereas the dates of paper receiving  $t_r$  are usually fixed very accurately. Different dates reflecting stages of papers processing are available for different scientific journals: date of revision, date of final acceptance, date of availability on-line, etc. It is necessary to specify the meaning of  $t_a$  for every particular journal. Besides, it is also interesting to consider various sets of  $t_w$  choosing different meanings of  $t_a$  for the same journal and to compare the obtained results. In our analysis, the  $t_a$  was defined as the date of revised version if the final acceptance date was omitted and as the final acceptance date (if present). So,  $t_w$  were calculated as the time differences between the date of submission and the most distant of two possible dates: revision date or final acceptance date.

Our goal was to determine the functional form of probability distributions  $P(t_w)$  based on the statistical data analysis performed for a few scientific journals. Another

task was to find if possible a typical form of  $P(t_w)$  for normally working Editorial Board.

Several journals with different Editorial Boards were chosen in our study: three of them belong to the international Elsevier Publishing House (“Physica A: Statistical Mechanics and its Applications”, “Physica B: Condensed Matter” and “Information Systems”) [7]. One more journal is rather new “Condensed Matter Physics” (published by the Institute for Condensed Matter Physics: [www.icmp.lviv.ua](http://www.icmp.lviv.ua)). The publicly available data from the official web-sites were used for analysis (Fig. 2). Also we tried to get the corresponding statistics of “Scientometrics”, although the data set is too small because the required dates for papers are available online only for several last years.



**Fig. 2** An example of publicly available data (the official web-site of the journal “Physica A”) which were used for our research.

Some formal parameters of databases used in this part of our work are shown in table 1. As we can see from the table, the typical number of records for each journal is of order of  $10^3$  which allows to make some quantitative conclusions. These general conclusions hold even for a more poor statistics (c.f. results for “Condensed Matter Physics” in Fig. 6). Zeros in the table mean that for some papers their submission date is coincide with the final acceptance date. But what is even more interesting, in every journal one can find papers with very long waiting periods (for example, 2260 days it is more that 6 years!). Oh course, we can only speculate about the possible reasons for that. For example, it could be long discussion about the manuscript or banal misprint.

At the first stage the probability histograms of waiting times  $P(t_w)$  for selected journals were constructed [7]. All experimental values were distributed among discrete intervals (bins) of length equals to 5 days.

Our purpose was to verify the functional form of  $P(t_w)$  and to refer it to the power-law-like class (non-Poisson processes) or, for example, to the exponential-like class (Poisson processes). The exponential distributions of random variables  $t_{\text{int}}$  and  $t_w$  are evidences of the random selection of tasks to execute [3, 10]. In Fig. 3 we see the  $P(t_w)$  distribution for journal “Physica A”. It has a form of a unimodal non-symmetrical distribution with a smooth decay. Since the distribution is skew, the mean value  $t_w^{\text{mean}}$  does not coincide with the typical value  $t_w^{\text{typ}}$ , at which maximum in  $P(t_w)$  occurs. Both

**Table 1** Characteristics of the data sets analysed: general number of records, maximal ( $t_w^{\max}$ ), minimal ( $t_w^{\min}$ ), typical ( $t_w^{\text{typ}}$ ), mean ( $t_w^{\text{mean}}$ ), and median ( $t_w^{\text{med}}$ ) waiting times for the journals under consideration.

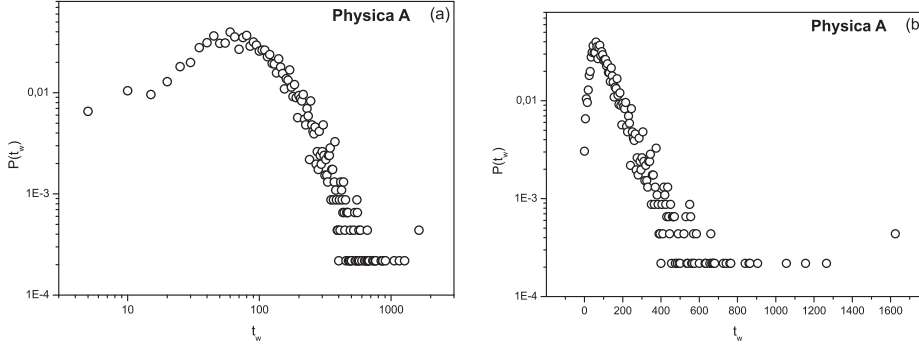
	“Physica A” (1975–2010)	“Physica B” (1988–2010)	“Information Systems” (1975–2010)
Number of records	4576	4944	814
$t_w^{\max}$ , days	1629*	1087 <sup>‡</sup>	2260 <sup>†</sup>
$t_w^{\min}$ , days	0	0	0
$t_w^{\text{typ}}$ , days	60	80	245
$t_w^{\text{mean}}$ , days	124	122.2	331.7
$t_w^{\text{med}}$ , days	95	90	275

\* I.A. McLure, A.-M. Williamson, Physica A, 1996, **234**, Iss. 1–2, 206–224; ibid. 225–238.

<sup>‡</sup> V.G. Bar’yakhtar, V.A. Popov, Physica B, 1999, **269**, Iss. 2, 123–138.

<sup>†</sup> M. Binbasioglu, D. Karagiannis, Information Systems, 2000, **25**, Iss. 6–7, 453–463.

the mean, typical and median values of  $t_w$  are given in the table 1. The log-log and log-linear plots of Fig. 3 demonstrate good possibilities for linear approximations of  $P(t_w)$  in both scales and this situation is analogous for other journals analysed [7].



**Fig. 3** (a) Log-log plot and (b) linear-log plot of the  $P(t_w)$  distribution for journal “Physica A”.

Further, we have verified two main hypotheses about the form of probability distributions which are used to describe human activity processes: (i) log-normal distribution [9]:

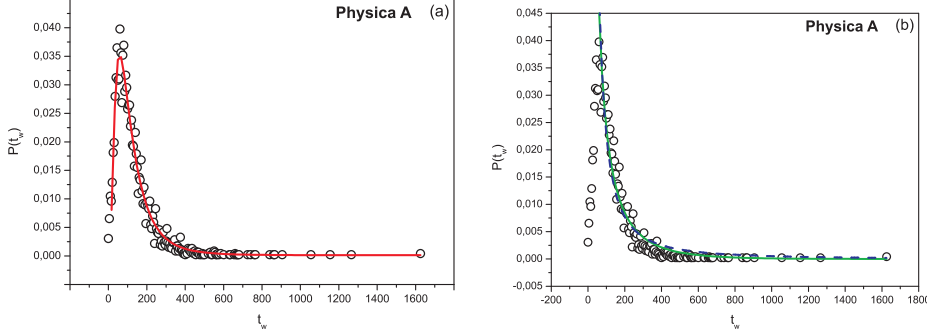
$$P(t_w) = P_0 + \frac{A}{\sqrt{2\pi}\omega t_w} e^{-\frac{[\ln(\frac{t_w}{t_c})]^2}{2\omega^2}}, \quad t_c, \omega > 0, \quad (3)$$

where  $\ln(t_c)$  and  $\omega$  are the mean and standard deviations of the  $\ln(t_w)$ ,  $P_0$ ,  $A$  are fitting constants; and (ii) power-law distribution with exponential cutoff [5] for exponent values  $\alpha = \{1; 3/2\}$ :

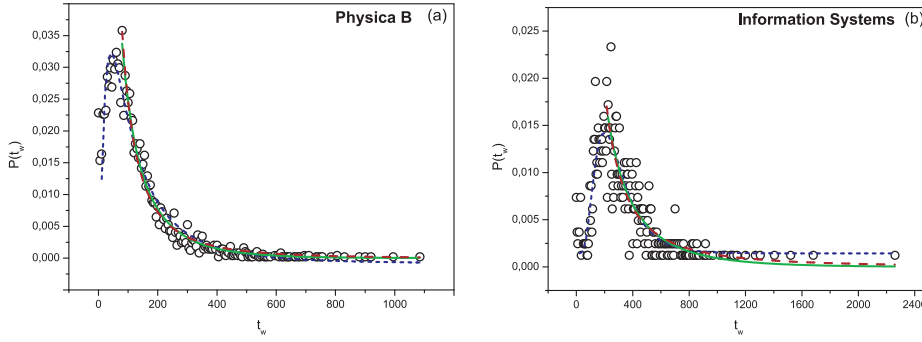
$$P(t_w) = A t_w^{-\alpha} e^{-\frac{t_w}{t_0}}, \quad t_0 > 0, \quad (4)$$

where  $t_0$  is characteristic of waiting time which depends on traffic intensity,  $A$  is a constant. Using fitting procedure we found optimal parameters for both distributions

(3) and (4). The results of fits obtained for journal “Physica A” are shown in Fig. 4 by smooth curves.



**Fig. 4** The  $P(t_w)$  distribution for journal “Physica A” with different approximation curves: (a) log-normal (3) (solid line, red online), (b) power-law with exponential cutoff (4) with  $\alpha = 1$  (light solid line, green online) and  $\alpha = 3/2$  (dashed line).

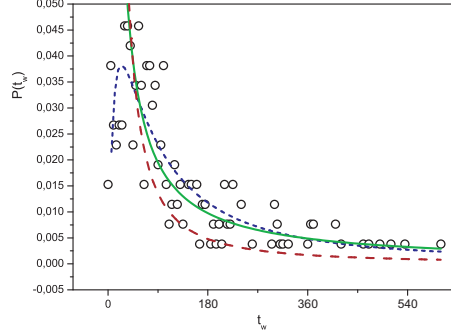


**Fig. 5** The  $P(t_w)$  distribution for (a) “Physica B” and (b) “Information Systems” journals. The dotted dark (blue online) lines are the approximations by log-normal (3), the light solid (green online) and dark dashed (red online) lines – by power-law with exponential cutoff (4) with  $\alpha = 1$  and  $\alpha = 3/2$ , respectively.

To compare the accuracy of approximations by different functions (log-normal (3) and power-law with exponential cutoff (4)) we exploited the criterium based on the value of the adjusted coefficient of determination  $\bar{R}^2$  [8]. This coefficient is used to verify the closeness of experimental data to the non-linear theoretical curve and is a modification of statistical coefficient of determination  $R^2$  which is the square of the sample correlation coefficient between the outcomes and their predicted values. A value of  $\bar{R}^2$  close to 1 indicates that the fit is a good one. For example, for the journal “Physica A” we have found that both log-normal (3) ( $\bar{R}^2 \approx 0,97$ ) and power-law function with exponential cutoff (4) and exponent  $\alpha = 1$  ( $\bar{R}^2 \approx 0,95$ ) can be the probable functions of distributions  $P(t_w)$ . The value of  $\bar{R}^2$  for power-law approximation

function with exponential cutoff (4) and exponent  $\alpha = 3/2$  is slightly smaller ( $\approx 0,92$ ) for this journal.

In fact, both log-normal and power-law functions predict the same leading behavior  $t^{-1}$ , differing only in the functional form of the exponential correction [10]. The advantage of hypothesis about log-normal functional form of  $P(t_w)$  consist in the possibility to describe all the data span, not only the tail. The results of analogous approximations



**Fig. 6** The  $P(t_w)$  distribution for “Condensed Matter Physics” journal. The dotted dark lines (blue online) are the approximations by log-normal (3), the light solid (green online) and dark dashed (red online) lines – by power-law with exponential cutoff (4) with  $\alpha = 1$  and  $\alpha = 3/2$ , respectively.

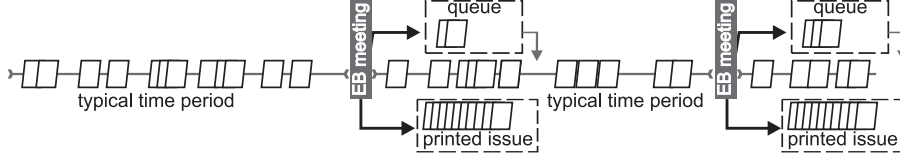
obtained for “Physica B” and “Information Systems” journals are presented in Fig. 5. For all journals analysed the conclusions are common: the both hypothesis about possible data approximations by log-normal (3) and by power-law with exponential cutoff (4) and  $\alpha = 1$  are almost equally good. Moreover, these conclusions are also right for the “Condensed Matter Physics” journal in spite of much smaller database with only 262 records (see Fig. 6). The observed data fluctuations can be explained by relatively small statistics but such situation is usual for the majority of scientific journals.

We could resume that it is hard to discriminate between the power-law or exponential nature of the tail of the  $P(t_w)$  distributions. But as is easy to see from obtained results the functional form of these distributions is the same: one explicit maximum and the long tail with several large values of  $t_w$ . The tail of the distributions built for several journals could be well approximated by functions with an exponential cut-off and leading power-law behavior  $t^{-1}$ . Thus, we could consider the obtained form of probability distributions  $P(t_w)$  as the typical one that can be used for scientometrical analysis of a given journals.

## 2 Editorial process modeling

We came to conclusion about the typical form of waiting time distributions  $P(t_w)$  for scientific journals with normally working Editorial Boards based on the results described above. The origin of such functional form of  $P(t_w)$  distributions is unknown. We can suppose that the contribution of human dynamics could be the reason of observed affinity of  $P(t_w)$  to power-laws. The peer-reviewing stage (including the work

of authors and the communication process) is the human activity probably most similar to “natural” in comparison with the rest stages of editorial process. The other phases consist of different periodical tasks (Editorial Board meetings, uploads to web-site, etc.) or work with manuscripts in order of receiving (i.e., language and technical editing).



**Fig. 7** The schematic representation of modelled editorial work in scientific journals.

To verify the hypothesis about the key role of peer-reviewing in the waiting times distributions  $P(t_w)$  shaping we built the simple simulation model of editorial work in scientific journal omitting the peer-reviewing [11]. Below we show the (expected) crucial difference of the waiting time distributions in such a model from the real data set analysed in the previous section. In the frame of this model, we consider the input flow of the submitted papers. Decision about manuscript acceptance is taken during regular meetings of the Editorial Board. All papers submitted before the meeting are considered (i.e. accepted or rejected) during this meeting. Generally, the Editorial Board meetings are held periodically and at least once before publishing of each issue. Let us define the typical journal period  $T$  as a time interval (in days) between two consecutive journal issues. For example, since 1988 the journal “Physica A” has 24 issues per year and in this case  $T = 15$  days. For “Condensed Matter Physics” journal (Fig. 6)  $T = 90$  days since 1997 year. So, in our model the period between two consecutive meetings equals to the typical journal period  $T$ . Now the values of waiting time  $t_w$  for each published paper could be calculated as the number of days between the moment of its receiving and the closest Editorial Board meeting.

In the absence of peer-review all the received manuscripts are supposed to be considered by the Editorial Board. In this case the presence of some constraints is important (for example, the limited size of the issue). For simplicity all the papers in our model have an equal number of pages, so the maximal size of a single issue could be limited by number of papers<sup>1</sup>. The value of parameter called the traffic intensity  $\rho$  (2) allows us to distinguish three regimes of work [5]:

- the input flow of manuscripts is too slow – all the papers are accepted for publication but the issue is incomplete (subcritical regime,  $\rho < 1$ );
- the number of received manuscripts is equal to the size of issue – all the papers are accepted for publication and the issue is complete (critical regime,  $\rho = 1$ );
- the number of received manuscripts is larger than maximum number of papers in one issue – a part of papers are accepted and the other are waiting in the queue for the next issue (supercritical regime,  $\rho > 1$ ).

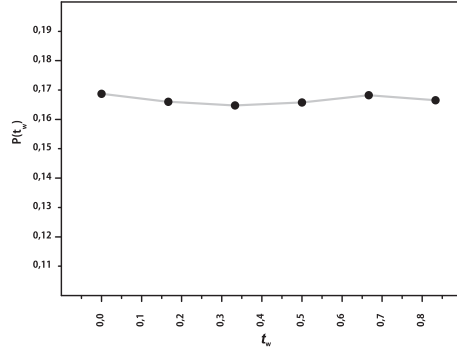
Obviously, the first regime of editorial work is not effective due to the incompleteness of issues. The third regime is also not realistic due to the endless queue of papers and therefore increasingly large values of waiting time. The second regime could be

<sup>1</sup> We specify the issue size equals 10 papers in our models.



considered as a perfect one since the issues are complete and the paper publishing without delays. But this regime is not stable and it could not be reached in practice because it is impossible to control the number of input manuscripts from different authors. It is more probable to provide the critical regime with  $\lambda \approx \mu$ , when the queue of papers periodically appears but it does not grow infinitely. So, the existence of limited queue is necessary to provide the completeness of issues being some kind of reserve.

We start modeling with the simplest case when the number of input manuscripts is determined and equals to the size of issue (determined input flow). Besides, we set also the minimal possible size of printed issued. All the issues which are smaller than 80% from standard issue size are considered as incomplete. As manuscript submission times are uniformly distributed and all of them are accepted for publication, the resulting  $P(t_w)$  distribution is uniform too, see Fig. 8. In this figure and further each point means the probability for the published paper to have waiting time in the interval  $t_w \in [t_w^i, t_w^{i+1})$ ; the value of  $t_w$  is measured in number of typical journal periods  $T$ . The results were obtained from the time-series simulations each of length 900  $T$ .



**Fig. 8** The  $P(t_w)$  distribution for the modeled periodical where the number of submitted manuscripts equals to the number of published papers (determined input flow).

In practice the number of received manuscripts could not be always equal to the number of published papers. Traditionally, the input flow of tasks from an independent sources is modeled as the Poisson flow:

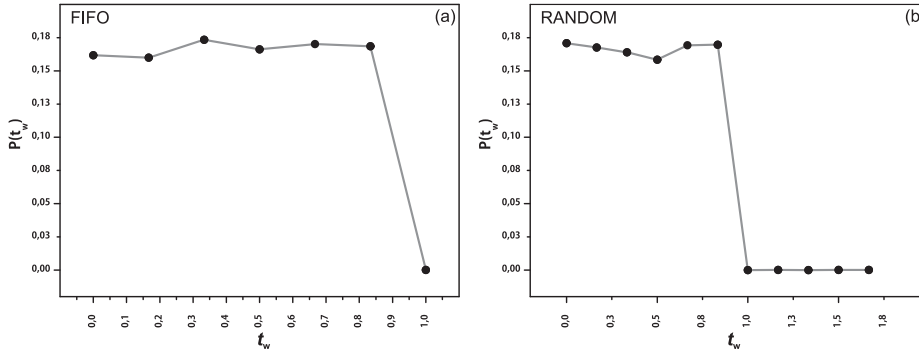
$$P_k(t) = \frac{(\lambda t)^k}{k!} \exp(-\lambda t), \quad k \geq 0, \quad t \geq 0, \quad (5)$$

here,  $k$  is the number of input tasks during time interval  $t$ ,  $\lambda$  is the input flow intensity or the number of tasks which were received during the time unit. Poisson flow is also characterized by the exponentially distributed time intervals between two consecutive tasks. So, the modeling of Poisson flow mostly means generation of series of exponentially distributed random variables (for example, see [5]). This approach is convenient for the cases when the execution law is also specified by the Poisson law. Then it is possible to study different work regimes of the system controlling the values of intensities of input and execution laws.

In the case of our model (omitting the peer-reviewing) we don't need to specify the execution law since all the papers could be accepted at one moment at the Editorial

Board meeting. So, the execution rate  $\mu$  could be expressed by the number of published papers while the number of received manuscripts could naturally define the arrival rate. Consequently, we need to simulate the input flow in a way allowing to control the input intensity by the number of received manuscripts.

We generate the random value distributed by Poisson law (5) with some value of  $\lambda$  (input intensity). In this case different number of manuscripts (which may be larger or smaller than  $\lambda$ ) could be received during the typical journal period  $T$ . Further, having the number of received papers we distribute them randomly over the  $T$ . If the number of manuscripts exceeds issue size, than a part of them goes to the queue or could be rejected. There are two ways of manuscript choosing from the queue (and also from the input flow) in our model: “FIFO” (first-in-first-out) and “RANDOM”. We can suppose that the second way could be the simplest method to reflect the situation with the numerous continuous priorities.

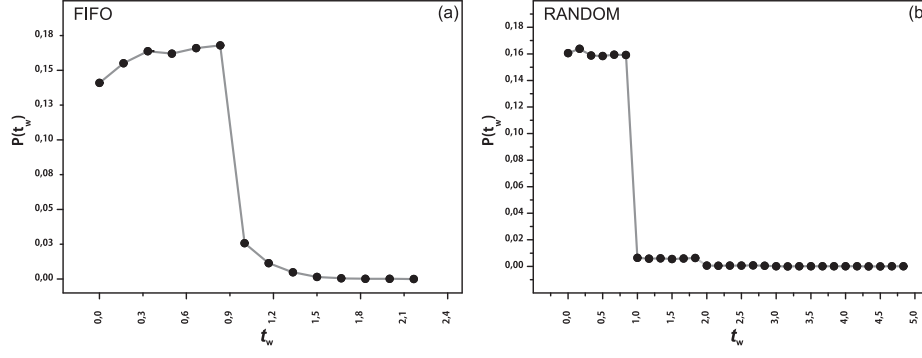


**Fig. 9** The  $P(t_w)$  distribution for the modeled periodical where input rate is comparably small:  $\lambda = 3$ ,  $\mu = 10$ . Two scenarios of manuscript choosing from queue are used: (a) FIFO and (b) RANDOM.

At first we modeled the case with non-determined input flow of papers and without any limitations of queue length. Modeling the input flow using (5) we can control its intensity changing the value of  $\lambda$ . The modeling results are shown in Figs. 9 and 10. Here one can see the change of  $P(t_w)$  distribution form according to an increase of  $\lambda$ . If  $\lambda$  is small then queue doesn't exist and waiting times are distributed more or less uniformly or forming the following “steps”. In this case the majority of published issues is incomplete (i.e., above 98% incomplete issues in the case of  $\lambda = 3$  and  $\mu = 10$ ).

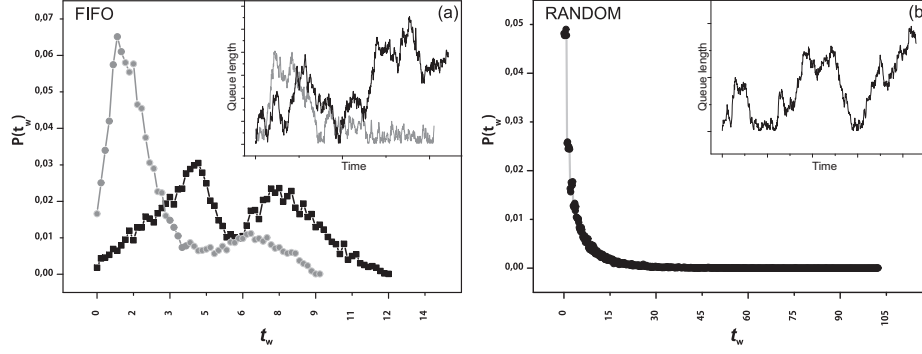
The queue appears when  $\lambda$  is of the order of magnitude of  $\mu$ . In this (critical) regime the queue length fluctuates around some value: the “excess” manuscripts from previous periods can fill the deficiency of papers for next periods. The  $P(t_w)$  distribution in this case has two distinct “steps” (Fig. 10) presenting two categories of papers: which are printed in the first following issue and which are reserved for next periods in the queue. In our model such critical regime was reached at  $\lambda = 7$  and  $\mu = 10$ . Then the number of incomplete issues descends down to 56%.

To minimize part of incomplete issues it is enough to increase  $\lambda$  still more. Our modeling results at  $\lambda = 10$  and  $\mu = 10$  are presented in Fig. 11. This case corresponds to the unsteady state of the system. Despite the fact that number of incomplete issues



**Fig. 10** The  $P(t_w)$  distribution for the modeled periodical where input rate is approximately equal to the value of execution rate:  $\lambda = 7$ ,  $\mu = 10$ . Two scenarios of manuscript choosing from queue are used: (a) FIFO and (b) RANDOM.

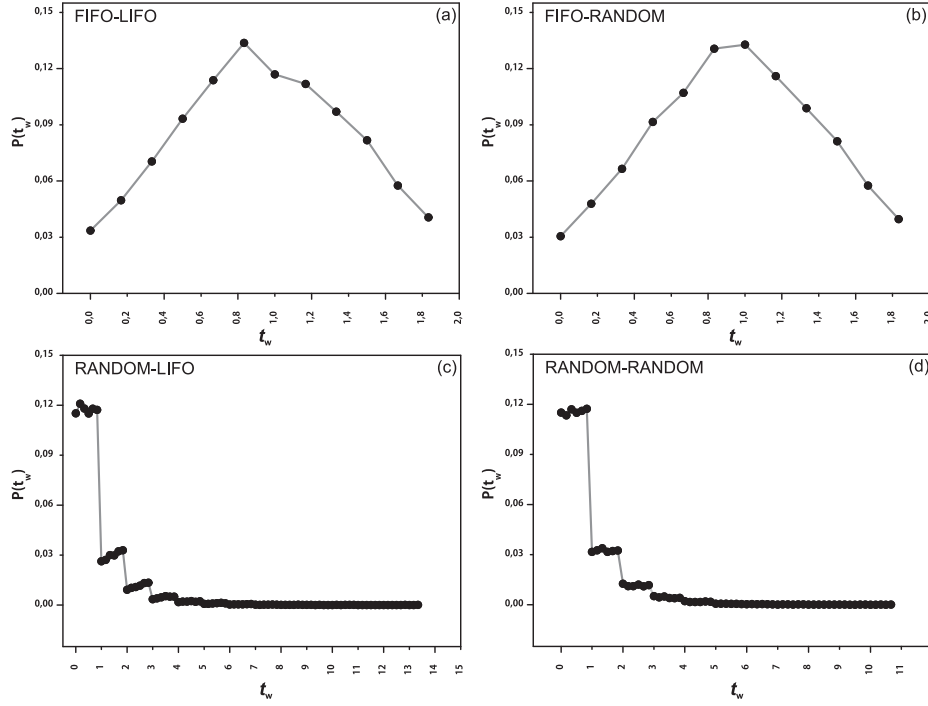
is close to zero, such work regime is not efficient due to increasing queue length (one can see the queue length growing on the corresponding insets in Fig. 11).



**Fig. 11** The  $P(t_w)$  distribution for the modeled periodical with  $\lambda = 10$  and  $\mu = 10$ . Two scenarios of manuscript choosing from queue are used: (a) FIFO (two cases) and (b) RANDOM. The queue length growing is shown on the corresponding insets.

We can conclude that it is impossible to reach the optimal work regime for Editorial Board in scientific journal without any artificial constrains. So, the next steps in description of this process may involve additional constrains into the model. We limit the queue length to the issue size specified before. In our case normal issue volume equals 10, so the queue length is limited to 10 also. Thus, such work regime could be called “the issue in reserve”. According to our rules the excess papers should be rejected using one of the scenarios: “LIFO” (last-in-first-out) and “RANDOM”.

As we can see from Fig. 12, the obtained functional form of  $P(t_w)$  distribution considerably differs from the experimental one. When the “FIFO” scenario is applied to select the manuscript from a queue the waiting time distribution is symmetric with one distinct maximum (Fig. 12 (a) and (b)). In the case of “RANDOM” selection rule the waiting time distribution has decreasing form but also several “steps” corresponding to



**Fig. 12** The  $P(t_w)$  distribution for the modeled periodical with  $\lambda = 10$  and  $\mu = 10$  using (a), (b) FIFO and (c), (d) RANDOM manuscripts selection rules. Two scenarios of excess papers rejection are used: (a), (c) LIFO and (b), (d) RANDOM.

each time period could be observed (Fig. 12 (c) and (d)). Besides, the rate of decreasing observed is larger (with value of exponent close to 3) and more close to the exponential function.

To summarize this section several aspects should be mentioned. First of all, it is important to note, that it is impossible to any real scientific journal to publish all the manuscripts received. So, every Editorial Board should choose the way or rule to eliminate the part of them: examining the execution of some obligatory technical requirements, applying peer-review mechanism, or following by other own internal criteria. The second important remark is that one can suppose that for different scenario it is possible to notice different picture of waiting time distribution for the published manuscripts. In this section we made the attempt to simulate most simple case of manuscripts arrangement in scientific journal, i.e. without any external peer review but using just simple rules. The obtained functional form of papers waiting time distributions for this scenario differs from the analogous results obtained for the real journals with peer-review mechanism. Of course, it is also interesting to simulate exactly the work with peer-reviewing but the way of natural human activity simulation is the subject of the discussions yet [3].

## Conclusions

We have found that both log-normal and power-law function with exponential cutoff and exponent  $\alpha = 1$  can be the probable functions of waiting time distributions  $P(t_w)$  for manuscripts in scientific journals. In fact, both log-normal and power-law functions predict exactly the same leading power behavior  $t^{-1}$ , differing only in the functional form of the exponential correction [10]. In this sense, process considered here is governed by similar probability distributions as other examples of human activities [1, 2, 3, 4, 5, 9]. The observed data fluctuations can be explained by relatively small statistics but such situation is usual for the majority of real-world data bases. Thus, we consider the obtained form of probability distributions  $P(t_w)$  as the typical one that can be used for scientometrical analysis of editions. The length of waiting times is an important characteristic of Editorial Board's activity. The publication delay effects journal rankings according to the impact factor [12] as well as personal citation rating of authors.

The simple model of Editorial Board work was created to verify the hypothesis about the important role of peer-reviewing in the waiting times distributions  $P(t_w)$  shaping. In general, the obtained results can be considered as the support of our previous conclusions.

In conclusion it is worth to mention some peculiarities of scientific editorial process that were not taken into consideration in our work. Here the main idea is connected with emphasizing of the meaning of natural human activity within the complex processes taking place in the Editorial Boards working. But these natural human activity patterns could be also affected by different situations or rules. For example, journal policy could be very different concerning the strictness of time deadlines for peer-reviewing or concerning the manuscripts with one "positive" and one "negative" referee reports. In addition to peer review we can mention other processes as the examples of natural human activity: technical work with raw manuscripts, communication between the editors and other participants of the editorial processes, etc. Moreover, one can distinguish several human activity sub-processes within peer reviewing such as pure referee work with manuscript, communication processes between referee, editorial office and authors, and, eventually, the manuscript revision by authors according to the referee remarks. It is very complex problem to account all these aspects in one model. So, it could be the worth challenge for the future analysis.

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